

contain Mesozoic rocks scarcely more than 60,000,000 years old. This shows that the Rockies are comparatively young mountains—a fact confirmed by their still great height. The much older Appalachian Mountains, extending into the Atlantic Provinces and the Gaspé Peninsula, contain no rocks newer than the Paleozoic, which ended some 200,000,000 years ago; moreover, they are more worn down by erosion.

## MOUNTAINS AND METALS

Mountain building is usually accompanied by igneous activity—volcanic eruptions and other movements of molten material from beneath the earth's crust. Usually, scientists believe, the tremendous weight of rock pressing down on this material keeps it in a solid state; but upward warping reduces this pressure, allowing it to liquefy and flow as magma; the resulting intrusions may be rich in valuable metals.

Some minerals are deposited by chemical precipitation in surface water. One example is limonite, a type of iron ore found in "bog iron" deposits in Quebec's St. Lawrence valley and elsewhere in Canada. This is formed where water seeping through rocks dissolves iron from them, then flows into bogs or pools containing decayed vegetable matter. The dissolved iron reacts with the carbon in this material to form a heavy brownish compound that settles on the bottom.

Some deposits are formed by the process of *replacement*. This is a slow piecemeal process whereby mineral-bearing solutions work their way through cracks and pores, dissolving the existing rock and substituting other minerals. These substances are known as *fossil fuels*, because they were formed from organic material trapped and buried with sediments laid down many millions of years ago. Part of the Paleozoic era is generally called the *Carboniferous* ("coal-bearing") period, because of the large

## MINERALS FROM SEDIMENTS

Metals and other useful minerals are also mined from sedimentary deposits. Sometimes a whole deposit, consisting of salt, limestone or some other industrial mineral, can be mined and used. Chalk is a form of limestone produced by the age-long accumulation of shells from countless tiny sea animals. The last part of the Mesozoic era, known as the *Cretaceous* period, is named from the chalk deposits formed at that time in northwest Europe.

Other sediments, known as *detrital deposits*, contain concentrations of heavy minerals such as iron, gold, platinum and uranium. Unconsolidated deposits of this kind, like the gold-rich gravels that yielded fortunes in the Klondike, are called *placers*. Most placers are found in ancient river beds, sometimes covered by other material deposited by glaciers.

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coal deposits formed from the swamps and forest of that time.

## THE GEOLOGY OF CANADA

A dominant feature of Canada's geology is the *Precambrian Shield*, which extends around Hudson Bay from the Arctic Ocean to the lowlands of southern Ontario and Quebec. Also known as the *Canadian Shield*, this is the core of the North American continent, containing some of the oldest rocks in the world. Over long ages these have been greatly eroded, then scraped almost bare by glaciers during the Pleistocene period which began perhaps 1,200,000 years ago.

The Canadian Shield is one of the most productive mining areas in the world, especially rich in such important base metals as copper, nickel, iron, lead and zinc. Among the other minerals produced are gold, silver, cobalt, asbestos, uranium, platinum, titanium and molybdenum.

Much of the soil from the Canadian Shield was deposited on the *Interior Plains*, producing the fertile agricultural land of the Canadian Prairies. Beneath this soil are Paleozoic and Mesozoic sediments that produce most of Canada's petroleum and natural gas. The Athabasca oil sands, extending more than 100 miles along the Athabasca River in northern Alberta, were deposited during the Cretaceous period.

Besides oil and gas, the Interior Plains contain enormous reserves of potash, especially in southern Saskatchewan. Other minerals produced on these plains include zinc, lead, salt, gypsum and limestone. Coal has been mined at many places in this region.

In the St. Lawrence and Hudson Bay Lowlands, bordering the Canadian Shield, the

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The Appalachian Region has yielded many valuable minerals, including many tons of iron ore from the now-closed Wabana mine in southeast Newfoundland. The region is still an important source of base metals, notably copper

in the Gaspé Peninsula. Newfoundland also produces asbestos and all of Canada's supply of industrial fluorite.

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Rivers undercut their banks as they hurry to the sea, sometimes widening their valleys as they carve new channels along the way. Meanwhile fast-flowing streams slowly deepen their valleys, and the sediment scoops up accumulates on the bottoms of lakes and makes them shallower. Around our lakes and along our sea-coasts, waves and currents produce similar effects as they pound the shoreline and shift great quantities of sand.

## WINDS AND GLACIERS

In many regions, winds are another important cause of erosion. Dust storms are a well-known hazard in some farming areas, blowing away valuable top soil. In desert regions sandstorms not only shift sand from place to place, but also act like a sandblast that scours and polishes larger rock fragments and outcrops of bedrock.

Glaciers still cause erosion in Canada's western mountains and in parts of the arctic. Near the higher mountain summits are masses of ice known as *alpine glaciers*, which survive even the hottest summers. Larger glaciers, known as *ice-fields*, are found in some mountain areas and over parts of Baffin Island, Greenland and other arctic regions.

Glaciers form wherever more snow falls in winter than melts in summer. The weight of fresh snow presses down upon the older, underlying layers, compacting them and turning them to solid ice. As snow continues to fall, the accumulating weight of snow and ice makes the lower part of the glacier flow like stiff molasses, until the ice melts at warmer altitudes. If fresh snow accumulates faster than the ice melts, the glacier grows and advances; if the ice melts more quickly, then the glacier shrinks and retreats.

Today, when we read about glaciers, we are apt to think only of the arctic or of high mountain ranges. But during the several ice ages much of the Northern Hemisphere was covered by ice. Our Great Lakes were left behind by the Laurentide Ice Sheet, which covered half of North America and retreated only some 10,000 years ago. This ice sheet not only re-

The slow, creeping flow of ice in a glacier causes erosion in much the same way as a fast-running stream. It picks up and carries along loose fragments of rock and other material, dropping them elsewhere when the ice retreated.

## PRODUCTS OF EROSION

The loose rock, gravel and other material deposited by glaciers form ridges called *moraines*.

Those left at the lower end or foot of the glacier are known as *terminal moraines*, and those left along the sides are *lateral moraines*. Loose boulders and other stray chunks of rock, dropped in the middle of a field or some other unlikely spot, are known as *glacial erratics*.